CLAIMS

What is claimed is:

1. A phase-compensating cube corner retroreflector, comprising:

an entrance/exit face;

a first rear reflecting face;

a phase-compensating film stack atop the first rear reflecting face, wherein the first phase-compensating film stack induces $2n\pi$ phase difference in light upon reflection, wherein n is an integer including 0;

a second rear reflecting face devoid of any phase-compensating film stack;

a third rear reflecting face;

another phase-compensating film stack atop the third rear reflecting face, wherein said another phase-compensating film stack induces the $2n\pi$ phase difference in light upon reflection;

wherein light enters and exits the cube corner retroreflector with substantially the same polarization orientation and substantially the same polarization ellipticity.

2. The retroreflector of claim 1, wherein the phase-compensating film stack and said another phase-compensating film stack each comprises a stack of thin films wherein reflections from the thin films interfere to induce the $2n\pi$ phase difference, and an interface between the last film and air provides total internal reflection.

3. The retroreflector of claim 1, wherein the phase-compensating film stack and said another phase-compensating stack each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of silicon dioxide having an optical thickness of approximately 815 nm;

a second layer atop the first layer, the second layer comprising titanium dioxide having an optical thickness of approximately 1066 nm;

a third layer atop the second layer, the third layer comprising silicon dioxide having an optical thickness of approximately 1090 nm; and

a fourth layer atop the third layer, the fourth layer comprises titanium dioxide having an optical thickness of approximately 1702 nm.

4. The retroreflector of claim 1, wherein the phase-compensating film stack and said another phase-compensating stack each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of magnesium dioxide having an optical thickness of approximately 715 nm; and

a second layer atop the first layer, the second layer comprising titanium dioxide having an optical thickness of approximately 1903 nm.

5. The retroreflector of claim 1, wherein the phase-compensating film stack and said another phase-compensating stack each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of titanium dioxide having an optical thickness of approximately 262.5 nm;

a second layer atop the first layer, the second layer comprising silicon dioxide having an optical thickness of approximately 346.5 nm;

a third layer atop the second layer, the third layer comprising titanium dioxide having an optical thickness of approximately 1018.5 nm;

a fourth layer atop the third layer, the fourth layer comprises silicon dioxide having an optical thickness of approximately 462 nm; and

a fifth layer atop the fourth layer, the fifth layer comprising titanium dioxide having an optical thickness of approximately 850.5 nm.

6. An optical system, comprising:

a polarizing beam-splitter that separates an input beam into at least one output beam having a specific polarization state; and

a cube corner retroreflector comprising at least two rear reflecting surfaces with phase-compensating film stacks, wherein the beam travels in a path comprising the cube corner retroreflector and the polarizing beam-splitter.

7. The system of claim 6, wherein the cube corner retroreflector comprises a first rear reflecting surface and a third rear reflecting surface with the phase-compensating film stacks.

8. The system of claim 7, wherein the phase-compensating film stacks each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n is an integer including 0, and an interface between the last film and air provides total internal reflection.

9. The system of claim 6, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of silicon dioxide having an optical thickness of approximately 815 nm;

a second layer atop the first layer, the second layer comprising titanium dioxide having an optical thickness of approximately 1066 nm;

a third layer atop the second layer, the third layer comprising silicon dioxide having an optical thickness of approximately 1090 nm; and

a fourth layer atop the third layer, the fourth layer comprises titanium dioxide having an optical thickness of approximately 1702 nm.

10. The system of claim 6, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of titanium dioxide having an optical thickness of approximately 1316 nm;

a second layer atop the first layer, the second layer comprising silicon dioxide having an optical thickness of approximately 1279 nm; and

a third layer atop the second layer, the third layer comprising titanium dioxide having an optical thickness of approximately 2595 nm.

11. The system of claim 6, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of magnesium dioxide having an optical thickness of approximately 715 nm; and

a second layer atop the first layer, the second layer comprising titanium dioxide having an optical thickness of approximately 1903 nm.

12. The system of claim 6, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of titanium dioxide having an optical thickness of approximately 262.5 nm;

a second layer atop the first layer, the second layer comprising silicon dioxide having an optical thickness of approximately 346.5 nm;

a third layer atop the second layer, the third layer comprising titanium dioxide having an optical thickness of approximately 1018.5 nm;

a fourth layer atop the third layer, the fourth layer comprises silicon dioxide having an optical thickness of approximately 462 nm; and

a fifth layer atop the fourth layer, the fifth layer comprising titanium dioxide having an optical thickness of approximately 850.5 nm.

13. An optical system, comprising:

a polarizing beam-splitter that separates an input beam into at least one output beam having a specific polarization state;

a quarter-wave plate;

a cube corner retroreflector comprising three rear reflecting faces with phase-compensating film stacks, wherein the output beam travels in a path comprising the quarter-wave plate, the cube corner retroreflector, the quarter-wave plate, and the polarizing beam-splitter.

14. The system of claim 13, wherein the phase-compensating film stacks each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n is an integer including 0, and an interface between the last film and air

provides total internal reflection:

15. The system of claim 13, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of silicon dioxide having an optical thickness of approximately 815 nm;

a second layer atop the first layer, the second layer comprising titanium dioxide having an optical thickness of approximately 1066 nm;

a third layer atop the second layer, the third layer comprising silicon dioxide having an optical thickness of approximately 1090 nm; and

a fourth layer atop the third layer, the fourth layer comprises titanium dioxide having an optical thickness of approximately 1702 nm.

16. The system of claim 13, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of magnesium dioxide having an optical thickness of approximately 715 nm; and

a second layer atop the first layer, the second layer comprising titanium dioxide having an optical thickness of approximately 1903 nm.

17. The system of claim 13, wherein the phase-compensating film stacks each comprises:

a first layer atop the corresponding reflecting face, the first layer comprising of titanium dioxide having an optical thickness of approximately 262.5 nm;

a second layer atop the first layer, the second layer comprising silicon dioxide having an optical thickness of approximately 346.5 nm;

a third layer atop the second layer, the third layer comprising titanium dioxide having an optical thickness of approximately 1018.5 nm;

a fourth layer atop the third layer, the fourth layer comprises silicon dioxide having an optical thickness of approximately 462 nm; and

a fifth layer atop the fourth layer, the fifth layer comprising titanium dioxide having an optical thickness of approximately 850.5 nm.

18. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first quarter-wave plate;

a measurement mirror mounted to a moving component to be measured;

a cube corner retroreflector comprising at least two rear reflecting surfaces with phase-compensating film stacks, wherein the measurement beam travels in a measurement path comprising the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, the polarizing beam-splitter, the cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, and the polarizing beam-splitter;

a second quarter-wave plate;

a reference mirror, wherein the reference beam travels in a reference path comprising the second quarter-wave plate, the reference mirror, the second quarter-wave plate, the polarizing beam-splitter, the cube corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the reference mirror, the second quarter-wave plate, and the polarizing beam-splitter.

19. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first quarter-wave plate;

a first cube corner retroreflector mounted to a moving component to be

measured, the first cube corner retroreflector comprising three rear reflecting surfaces with phase-compensating film stacks;

a second cube corner retroreflector comprising at least two rear reflecting surfaces with phase-compensating film stack, wherein the measurement beam travels in a measurement path comprising the first quarter-wave plate, the first cube corner retroreflector, the first quarter-wave plate, the polarizing beam-splitter, the second cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the first cube corner retroreflector, the first quarter-wave plate, and the polarizing beam-splitter;

a second quarter-wave plate;

a reference mirror, wherein the reference beam travels in a reference path comprising the second quarter-wave plate, the reference mirror, the second quarter-wave plate, the polarizing beam-splitter, the second cube corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the reference mirror, the second quarter-wave plate, and the polarizing beam-splitter.

20. The system of claim 19, wherein the phase-compensating film stacks of the first cube corner retroreflector each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n an integer including 0, and the last film provides total internal reflection.

21. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first quarter-wave plate;

a first cube corner retroreflector and a second cube corner retroreflector mounted to a movable component to be measured, the first and the second cube corner retroreflectors each comprising three rear reflecting surfaces with phase-compensating film stacks;

a third cube corner retroreflector comprising at least two rear reflecting surfaces with phase-compensating film stacks, wherein the measurement beam travels in a measurement path comprising the first quarter-wave plate, the first cube corner retroreflector, the first quarter-wave plate, the polarizing beam-splitter, the third cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the second cube corner retroreflector, the first quarter-wave plate, and the polarizing beam-splitter;

a second quarter-wave plate;

a reference mirror, wherein the reference beam travels in a reference path comprising the second quarter-wave plate, the reference mirror, the second quarter-wave plate, the polarizing beam-splitter, the second third corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the reference mirror, the second quarter-wave plate, and the polarizing beam-splitter.

22. The system of claim 21, wherein the phase-compensating film stacks of the first and the second cube corner retroreflectors each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n is an integer including 0, and the last film provides total internal reflection.

23. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first quarter-wave plate;

a measurement mirror mounted to a moving component to be measured;

a second quarter-wave plate;

a first cube corner retroreflector, a second cube corner retroreflector, and a third cube corner retroreflector each comprising three rear reflecting surfaces with phase-compensating film stacks, wherein the measurement beam travels

in a measurement path comprising the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, the polarizing beam-splitter, the first cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, the polarizing beam-splitter, the second quarter-wave plate, the second cube corner retroreflector, the second quarter-wave plate, the polarizing beam-splitter, the third cube corner retroreflector, and the polarizing beam-splitter;

a reference mirror, wherein the reference beam travels in a reference path comprising the third cube corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the second cube corner retroreflector, the second quarter-wave plate, the polarizing beam-splitter, the first quarter-wave plate, the reference mirror, the first quarter-wave plate, the polarizing beam-splitter, the first cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the reference mirror, the first quarter-wave plate, and the polarizing beam-splitter.

24. The system of claim 23, wherein the phase-compensating film stacks of the second cube corner each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n is an integer including 0, and an interface between the last film and air provides total internal reflection.

25. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first quarter-wave plate;

a first cube corner retroreflector mounted to a moving component to be measured, the first cube corner retroreflector comprising three rear reflecting surfaces with phase-compensating film stacks, wherein the measurement beam travels in a measurement path comprising the first quarter-wave plate, the first cube corner retroreflector, the first quarter-wave plate, and the polarizing beam-splitter;

a second quarter-wave plate; and

a second cube corner retroreflector comprising three rear reflecting surfaces with phase-compensating film stacks, wherein the reference beam travels in a reference path comprising the second quarter-wave plate, the second cube corner retroreflector, the second quarter-wave plate, and the polarizing beam-splitter.

26. The system of claim 25, wherein the phase-compensating film stacks of the first and the second cube corner retroreflectors each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n is an integer including 0, and the last film provides total internal reflection.

27. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first quarter-wave plate;

a measurement mirror mounted to a moving component to be measured;

a first cube corner retroreflector, comprising three rear reflecting surfaces with phase-compensating film stacks;

a second cube corner retroreflector, comprising at least two rear reflecting surfaces with phase-compensating film stacks, wherein the measurement beam travels in a measurement path comprising the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, the polarizing beam-splitter, the first cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, the polarizing beam-splitter, the second cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the measurement mirror the first quarter-wave plate, the polarizing beam-splitter, the first cube corner retroreflector, the polarizing beam-splitter, the first quarter-wave plate, the measurement mirror, the first quarter-wave plate, and the polarizing beam-

splitter;

a second quarter-wave plate; and

a reference mirror , wherein the reference beam travels in a reference path comprising the second quarter-wave plate, the reference mirror, the second quarter-wave plate, the polarizing beam-splitter, the first cube corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the reference mirror, the second quarter-wave plate, the polarizing beam-splitter, the second cube corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the reference mirror, the second quarter-wave plate, the polarizing beam-splitter, the first cube corner retroreflector, the polarizing beam-splitter, the second quarter-wave plate, the reference mirror, the second quarter-wave plate, and the polarizing beam-splitter.

28. The system of claim 27, wherein the phase-compensating film stacks of the the second cube corner retroreflector each comprises a stack of thin films wherein reflections from the thin films interfere to induce $2n\pi$ phase difference where n is an integer including 0, and the last film provides total internal reflection.

29. An interferometry system, comprising:

a polarizing beam-splitter that separates an input beam into a measurement beam having a first polarization and a reference beam having a second polarization;

a first cube corner retroreflector mounted to a moving component to be measured, first cube corner retroreflector comprising at least two rear reflecting surfaces with phase-compensating film stacks, wherein the measurement beam travels in a measurement path comprising the first cube corner retroreflector and the polarizing beam-splitter; and

a second cube corner retroreflector comprising at least two rear reflecting surfaces with phase-compensating film stacks, wherein the reference beam travels in a reference path comprising the second cube corner retroreflector and the polarizing beam-splitter.